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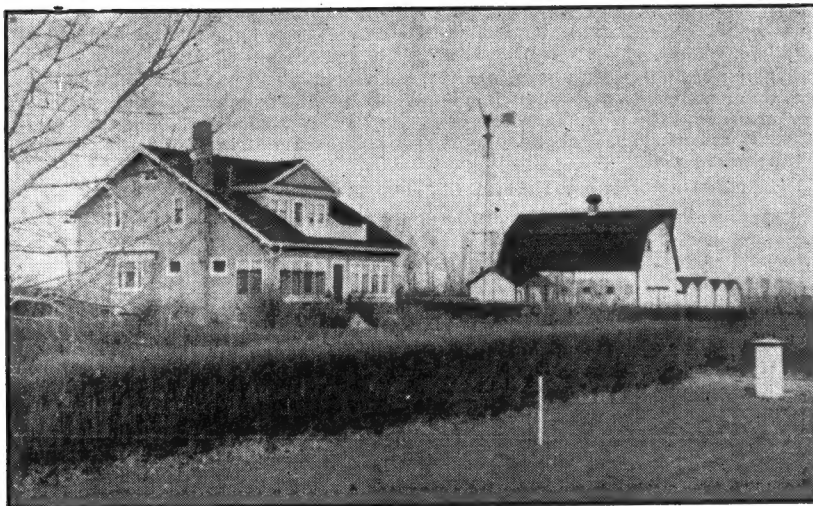
Bulletin No. 84

UNIVERSITY OF SASKATCHEWAN
COLLEGE OF AGRICULTURE



**Water and Disposal Systems
for Homes in Rural Saskatchewan**

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DEPARTMENT OF AGRICULTURAL ENGINEERING



A MODERN FARM HOME

SASKATOON, SASKATCHEWAN

WATER and DISPOSAL SYSTEMS for HOMES in RURAL SASKATCHEWAN

By EVAN A. HARDY

Every farm home has a water and disposal system of either a temporary or permanent nature. Some systems consist of only a water pail, wash basin and a slop pail, while others include hot and cold running water with a disposal system. Hot and cold running water along with a simple disposal system is not beyond the possibility of every farm home.

WATER

The source of all water is the rain and snow which fall upon the earth. The immediate sources of water supplies are rain which has been collected in cisterns or dugouts, surface water and ground water.

Ground water is recovered through wells or springs. Wells are classified as shallow and deep according to their relation to the uppermost impervious stratum. A shallow well is one which does not extend through the first impervious stratum of the earth. A deep well extends through the first impervious layer into a water-bearing stratum.

Shallow Wells

Water is obtained from shallow wells in many areas in Saskatchewan. Shallow wells may be dug by hand or bored with a well boring machine. The hand dug well is at least three feet in diameter. The cylindrical hole is more desirable than the rectangular because of the ease in preparing suitable cribbing. The cylindrical hole will stand with less danger than the square hole. Lumber well cribbing material is available for the preparation of cylindrical cribbing. Clay tile, brick or galvanized culvert material may be used as cribbing to protect the hole from caving in.

The water-bearing stratum for the shallow well may be sand or gravel. In some wells, the water comes from gravel stratum through which the water flows freely while in most shallow wells the flow of water is slow, coming through sand or quicksand deposits. Generally speaking, the shallow well should be as large in diameter as possible so that a storage of water will be available.

The piping and pump placed into the well should not be too large. The large pump takes water out of the well faster than it can run in without bringing sand, and all sorts of sediment into the well. A small cylinder and a slower rate of pumping is best. The 2½" to 3" cylinder with either 1½" or 1¼" pipe provides a pump of ideal proportions for the shallow well.

The following table lists the sizes of cylinders for wells of varying depths:

Cylinder		Well Equipment Specifications			
Size	Stroke	Capacity Imp. Gal. Per Hr.	Size of Pipe		Depth of Well
			Shallow	Deep	
2"	6"	163	1½"	2"	50'-200'
2½"	6"	250	1½"	2½"	25'-150'
3"	6"	370	1½"	3"	25'-75'
3½"	6"	500	1½"-1¼"	—	25'-50'

Cast iron cylinders are sufficiently high in quality to give satisfactory performance in the shallow well. However, the brass lined cast iron cylinder is frequently advisable where considerable pumping is required. The plunger may be cast iron or brass fitted with a flat disc valve and crimped leather. The check valve is usually a flat cut leather valve working on a brass seat. The ball check valve may be had for special cylinders. All pumps for shallow wells should be fitted with 3/8" or ½" galvanized iron pump rods to connect the cylinder plunger with the pump handle.

Where quicksand is the stratum supplying the water the small cylinder not larger than 2½" diameter operating with a short stroke will slow down the rate of pumping sufficiently so that the water can flow from the sand into the well without taking the sand with it. Filters to keep the sand out and let the water through have not been satisfactory. Where the water is deeper than three feet in the well, a filter consisting of a foot or so of coarse sand and gravel placed in the bottom of the well has been of assistance in keeping the quicksand out of the well. The sand point is not satisfactory when used in a quicksand well.

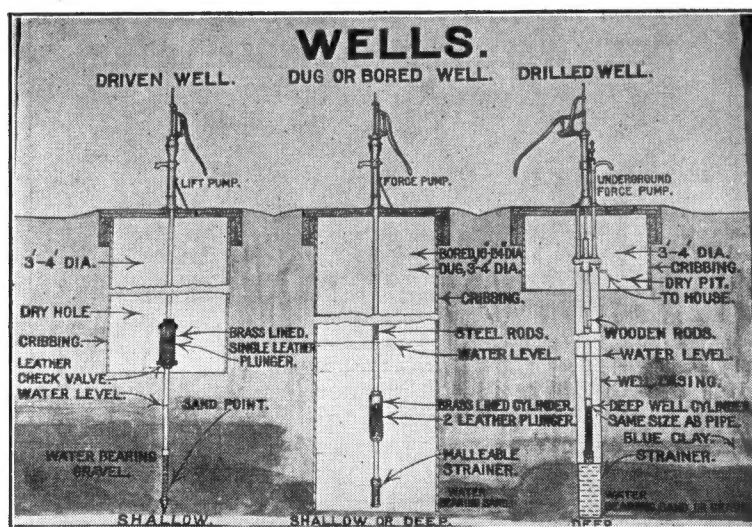


Figure 1.—Typical Well Installations

A sand point is of value where an ample supply of water is present in coarse sand or gravel. The sand point should be driven down into the water bearing gravel from the surface or from a dry well. The cylinder must be placed within 15 or 20 feet of the water level for satisfactory pumping. Frequently the water rises in the pipe above the water bearing gravel so that only a shallow dry well or pit is necessary for the cylinder. Sufficient pipe and pump rod will need to be fitted above the cylinder to the pump on the surface. A windmill is ideal power for slow rate pumping in the case of quicksand wells.

The shallow well dug in connection with the dugout may be fitted with a large sized pump, in many instances the 4" wooden pump. The well is usually fed from the dugout through a sand gravel filter. The sand gravel filter has large capacity without carrying in sediment. The large pump finds its place in this type of well.

Deep Wells

Where the water bearing stratum is deep, 100 to 500 feet deep, it is necessary to drill or put down a drilled well. A drilled well is formed by drilling and driving a casing, 4" to 6" in diameter, into the ground to the depth required to penetrate the water bearing stratum. A drilled well is satisfactory only when the water bearing stratum is gravel or water bearing rock.

The supply of water usually comes from some considerable distance at a higher elevation so that the water rises up in the casing from half to three-quarters of the depth of the well. The water bearing stratum must have capacity sufficient to supply the water at the rate of pumping without lowering the water level in the casing. Deep well cylinders operated with wooden rods fitted in 2" pipe make a balanced piping for deep well pumping.

Deep wells which are either bored or drilled should be fitted with piping and cylinder so that the check valve and plunger of the cylinder may be fitted without lifting the pipe, when it is necessary to repair or replace the leathers.

The deep well cylinder should be either brass lined or solid brass for best service. The cylinder is so designed that 2" cylinder will work with 2" pipe. The pipe is sufficiently larger than the plunger for drawing when replacing of the leathers is necessary. The well should be fitted with ash rods for operating the plunger. Either the windmill or pumping engine are suitable power in pumping.

The ejector pumping unit is desirable where electric power is available for either deep or shallow wells. The unit can usually be placed in the basement to provide pneumatic pressure for distribution as well. Where the well is over 150 feet deep from the surface to the water level, the entire unit must be placed at the head of the well. A small concrete unit house should be made over the top of the well so that the unit will be protected from frost.

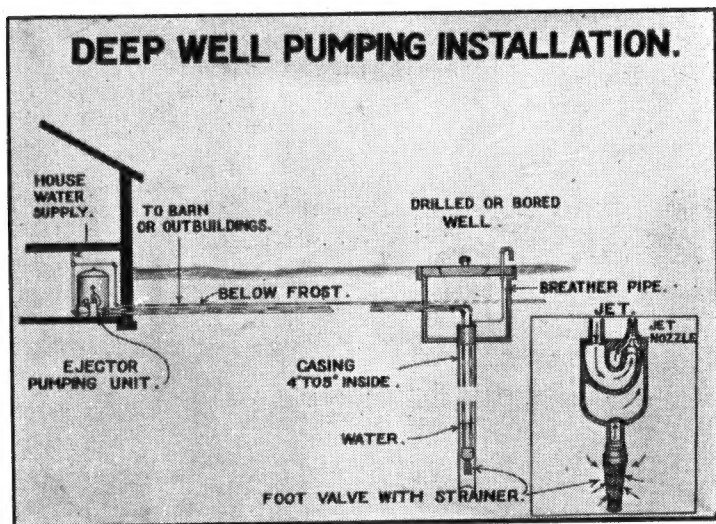


Figure 2.—Ejector Pump Installation

The Air Lift

Compressed air can only be used for pumping when the depth of water in the well equals the height of lift from the water level to the surface. The air lift has large capacity when suitable.

The piping consists of two pipes inside of the well casing, usually a $1\frac{1}{2}$ " or 2" pipe for the water and a $\frac{1}{2}$ " pipe for the air. The air must be released near the bottom of the water pipe.

Air is pumped down into the inner casing by means of a small air line. The air is released in layers which expand as they near the surface. The weight of the column of water and air is less than the column of water outside of the central pipe. Consequently the column of water and air are forced up to the surface and discharged from the well. Air pressures of from 40 to 90 pounds per square inch will be necessary, depending upon the depth of water and desired capacity. The power required to supply air for pumping is equal to that of pumping by other methods. The advantage of air pumping is the elimination of valves, cylinders, and pump rods.

Pumping from Springs or Streams

It is frequently desired to pump water from a running spring or stream to a higher point for stock watering or household use, by using the hydraulic ram.

The conditions necessary for the operation of the hydraulic ram are as follows: The ram must be placed usually in a pit some distance down stream from the source of water so that a supply pipe properly proportioned as to size and length may lead water to the ram through considerable fall. The delivery pipe will run from the ram up to the supply tank, barn or house. The vertical and horizontal length of the delivery pipe is limited by the total fall of the supply pipe, the amount of water available, and the amount desired at the point of delivery. The following table defines conditions suitable for the operation of a hydraulic ram:

Length of Supply Pipe Ft.	Supply Gal. Per Min.	Fall Supply Pipe Ft.	Size of Pipe		Height of Delivery Pipe Ft.	Amt. Del. in Gal. Per Hr.
			Supply	Delivery		
30	2-3	3	$\frac{3}{4}$ "	$\frac{3}{4}$ "	20	10-15
30	2-4	4	1"	$\frac{3}{4}$ "	30	10-20
40	3-7	5	$1\frac{1}{4}$ "	$\frac{3}{4}$ "	40	15-35
50	6-12	7	2"	1"	50	30-60
60	11-20	8	2"	1"	60	55-100
100	30-60	14	$2\frac{1}{2}$ "	$1\frac{1}{4}$ "	100	150-300

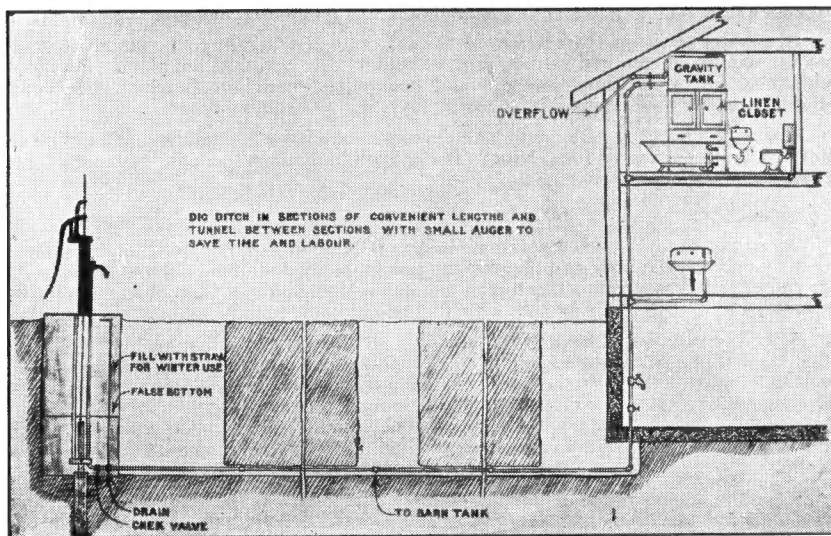


Figure 3.—Underground Force Pump for House Piping

Instructions which come with the purchase of a hydraulic ram should be carefully followed. All pipes should be tested for leaks before they are covered. The installation should be protected from frost or else drained during cold weather.

DRINKING WATER

A good supply of well water is most desirable for drinking and for stock watering. Good drinking water may be too hard for satisfactory use in the kitchen or in the laundry. It is usually impractical to attempt to soften hard well water for kitchen and laundry purposes. Where the water supply is difficult to get and the water is hard, the water must be analyzed for hardness before any intelligent effort can be made to provide a softening system. Water analyses may be had from the University of Saskatchewan, or the Department of Public Health, upon application. This service is available so that more accurate knowledge may be had of the suitability of the local water supply for human consumption and stock watering purposes.

Hard Water Softeners

The zeolite water softener is an exchange-silicate softener. Zeolites may be classified for practical purposes into two groups based upon their physical structure as porous zeolites and non-porous or solid zeolites. The porous zeolites are manufactured by different processes and from different materials. The solid zeolites are found in deposits of marine origin and are washed and scoured to remove any clay coating from the grains or pebbles.

The zeolites used are silicates of aluminum, iron, or other metal combined with bases of sodium or potassium. These silicates possess the property of exchanging their associated basis for the calcium and magnesium of the water.

The zeolite softener is built in a number of different forms. For small units the tank has a capacity of from 6 to 60 gallons. The zeolite is placed at the top upon a filter of layers of sand and gravel. The total depth of sand and gravel is about 18" with a foot of zeolite. The water enters the softener, at the top, flowing down through the zeolite and sand.

How the Water is Softened

Water coming through the zeolite bed exchanges the sodium base of the zeolite for the magnesium or calcium base of the water, reducing the water to zero hardness, the calcium and magnesium being retained by the zeolite. The chemical reaction is as follows: Sodium zeolite + calcium bicarbonates = carbon zeolite = sodium bicarbonate. This continues until all of the exposed sodium salts are used up. If more raw water is passed through, it will not be affected and will flow from the softener in its virginal hard state.

Regeneration

It is then necessary to regenerate the softener in order to exchange the calcium base for sodium of common salt (sodium chloride). The chemical reaction is as follows: Calcium zeolite + sodium chloride = sodium zeolite + calcium chloride. The calcium chloride must be washed out of the zeolite layer to the drain or sewer.

Where the water is hardened by the presence of magnesium instead of calcium the reactions are the same as for calcium. The magnesium chloride would be washed from the zeolite when regenerated.

Regenerating

When regenerating, from seven to twelve pounds of salt is placed in the softener either by opening the tank and pouring the salt in, or by dissolving the salt in the water and running the water into the top of the tank. Considerable time is taken to allow the salt brine to come into contact with the zeolite for the exchange of base.

After the salt has permeated the zeolite, it is washed out of the zeolite by running water back through the softener. As soon as all traces of the salt have disappeared the chloride is washed from the zeolite by passing water through the filter in the normal way, discharging the chloride to the drain through a by-pass or vent. As soon as the water is clear and tests soft with a soap solution, the softener is again ready for use. In the small softener for private homes, water should not be used faster than eight gallons per minute. If a greater quantity is needed, a larger softener must be provided.

Softening water by means of a zeolite softener does not aid materially in making water more palatable for drinking purposes. Calcium bicarbonate or magnesium sulphate will taste no worse than sodium bicarbonate or sodium sulphate. The softened water will be much more desirable when used with soap, but will not be materially improved for drinking. The soft water will not form scale in water front or coils as when hard. Water should be tested before an attempt is made to soften it. The amount of zeolite required depends to a considerable degree upon the hardness of the water. Iron hard water cannot be softened with the zeolite softener. Softeners of this type are available through building and plumbing supply firms. They are simple to install and maintain and will function for many years.

Further information on the treatment of water may be had from the bulletin entitled "Treatment of Farm Water Supplies," by the Prairie Rural Housing Committee available at the Department of Agriculture, Regina, and the University of Saskatchewan, Saskatoon, Saskatchewan.

WELL WATER INSTALLATION FOR RURAL HOMES

Well water may be piped into the house so that a supply of drinking water and water for cooking may be had in the kitchen.

Figure 3 illustrates a well fitted with an underground force pump, a pipe line to the house, and a simple gravity tank installation for the house.

The size of pipe used for the pipe line from the well to the house depends upon the length of the line and the desired rate of pumping. Friction of water in pipes is equivalent to increasing the delivery head of the pump and increases the power required to operate the pump. A deep well pump fitted with a 2" cylinder operating with an 8" stroke at 35 strokes per minute, will deliver three gallons per minute. A pump fitted with a 2½" cylinder will deliver four gallons per minute when operating 35 6-inch strokes per minute while a pump with a 3" cylinder operating 35 6-inch strokes per minute will deliver five gallons per minute. Three-quarter inch pipe is the correct size for a line from the well to the house for a pump fitted with a 2" or 2½" cylinder when the length of the line is not more than 200 feet. For the 3" cylinder, 150 feet of pipe line is satisfactory with ¾" pipe. For distances greater than 200 feet, ¾" pipe size is satisfactory where the pump delivers a smaller quantity of water per minute. A windmill usually is best, or if an engine is used the speed of the pump jack should be slowed down to suit the length of pipe. One inch pipe will serve for the full capacity of the cylinder at twice the length of line of that of ¾" pipe.

It is not always necessary to dig a ditch all the way when putting in the pipe line. A 20-foot trench at one end of the line for a short pipe line and at both ends for longer installations is all that is necessary. Three-foot holes can be dug down to the pipe level every 20 to 40 feet so that an auger can be guided from the 20-foot trenches through to the end. Where the soil is hard clay filled with stone, it will not be possible to bore through with an auger and the entire length of ditch will have to be dug. The line should be 6 to 8 feet deep to be protected from the frost. It should be laid with a slight grade to the well so that the entire system could be drained into the well if desired.

FARM & HOME WATER SYSTEM INSTALLATION. SHALLOW WELL.

THE TOTAL LIFT TO PUMPING UNIT
SHOULD NOT EXCEED 20', THIS INCLUDES
DIFFERENCE IN HEIGHT BETWEEN WATER LEVEL
AND PUMPING UNIT, PLUS LOSS DUE TO FRICTION
IN PIPE.
ALL CONNECTIONS MUST BE TIGHT.

LOSS IN FEET OF HEAD PER 100' OF PIPE.

GALS. PER MINUTE	PIPE SIZE			
	3/4"	1"	1 1/4"	1 1/2"
5	18.6	4.4	1.5	0.6
10		15.6	5.3	2.2
15		24	8.1	3.3

ONE ELBOW HAS RESISTANCE OF
10' STRAIGHT PIPE.

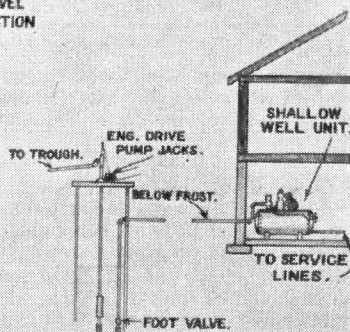


Figure 4.—Power Pump for the Shallow Well

Where suitable well water for drinking is not available, spring or well water from the neighbour's may be hauled to the house and stored in a concrete cistern built particularly for drinking water storage. Water, stored in a cistern placed in the ground below the cellar floor or under the house, remains cold and palatable at all times. A pump placed at the kitchen sink and piped from the drinking water cistern is a convenient means of bringing the water to the kitchen when needed. Where soft water is used for drinking the roof should be of galvanized iron and the water should be filtered through a sand filter before being stored, so that all refuse from the roof might be removed before the water goes into storage. Rain water which is clean and properly stored is quite good for drinking.

Water Filters

A sand-gravel water filter for filtering rain water for drinking purposes must be large enough to hold and filter all of the water from the roof during any torrential rainfall. The bulletin prepared by the Provincial Health Department, entitled "Safe Water Supplies," illustrates two larger types of soft water filters. These are designed as a part of the rectangular concrete cistern.

A much smaller filter placed in the cistern and constructed of one layer of soft common brick laid up over the end of the suction pipe of the cistern pump serves as a filter for cleaning water as it is removed from the cistern. Such a filter should provide at least 10 square feet of area for a 3" hand operated cistern pump. The water seeps through the bricks when being pumped from the cistern.

WATER STORAGE

Rain water for the kitchen and laundry must be collected from the roof of the house, barn or sheds in cisterns and stored. The storage may be of a temporary nature such as barrels, tank wagon, galvanized iron tank, or of a permanent nature such as galvanized iron or concrete cistern.

SIZE OF CISTERN

The cistern should be large enough so that all of the rain or snow water which comes from the roof can be collected in the storage. Such a cistern will need to store from 2,000 to 5,000 gallons, depending upon the size of the building supplying the water. The table on page 8 indicates the capacity of cistern per foot of depth.

The average size house of 26 x 30 would need storage for 2,250 gallons of water to provide for from 4" to 6" of rain, which generally falls through May, June and July. A cistern 8 feet in diameter and 10 feet deep with a capacity of 3,141.7 gallons or one 8 feet x 10 feet x 6 feet deep with a capacity of 3,000 gallons would be large enough.

Diameter of circular cistern in ft.	Imp. gals. ft. of depth	Size of rectangular cistern in ft.	Imp. gals. ft. of depth
6	175.50	6 x 8	300.00
7	240.00	6 x 10	375.00
8	314.17	6 x 12	450.00
9	397.00	8 x 8	400.00
10	490.87	8 x 10	500.00
		8 x 12	600.00
		10 x 10	625.00

Note.—One cubic foot equals 6.25 Imperial gallons.

The circular cistern is in most cases quite satisfactory and much less expensive to build. Any soil which will stand long enough to be plastered will provide support for a well-formed, plastered, cement wall of a cylindrical shape.

THE CEMENT PLASTER CISTERN

The cistern should be located so that the greatest protection from frost will be had. Where the surface water is not too shallow the cistern can be placed below the cellar floor. The outside location is not as desirable as under the house or in the bottom of the cellar because of the frost.

A concrete retaining wall extending down to the bottom of the frost penetration is necessary. It should be from 6" wide at the bottom to 8" or 10" wide at the top. The walls should consist of one part cement and six parts clean sharp gravel mixed with as little water as possible to form concrete of the proper consistency. Where a concrete slab is desired for a top, reinforcement rods should be placed in the retaining ring so that they will serve as reinforcement into the slab. Where a wooden top is desired 2 x 6 or 2 x 8 floor joists should be placed into the top of the ring as the concrete is poured and then removed after the wall has set so that the rest of the digging can be done without interference from the joists.

As soon as the retaining ring is set the dirt should be dug out from the centre. The dirt walls should be carefully trimmed so that they will be smooth and even with the face of the inside of the retaining ring. When the centre is dug out to a depth of about 5 feet the inside surface of the concrete ring and the surface of the dirt walls below should be plastered with two coats of cement plaster consisting of one part cement and two parts clean sharp sand. The plastered cement walls will be from $\frac{3}{4}$ " to 1" in thickness. The digging can then be completed or continued for another 5 feet, or as much as can be reached without a scaffold, and then plastered as the walls above. The floor should be

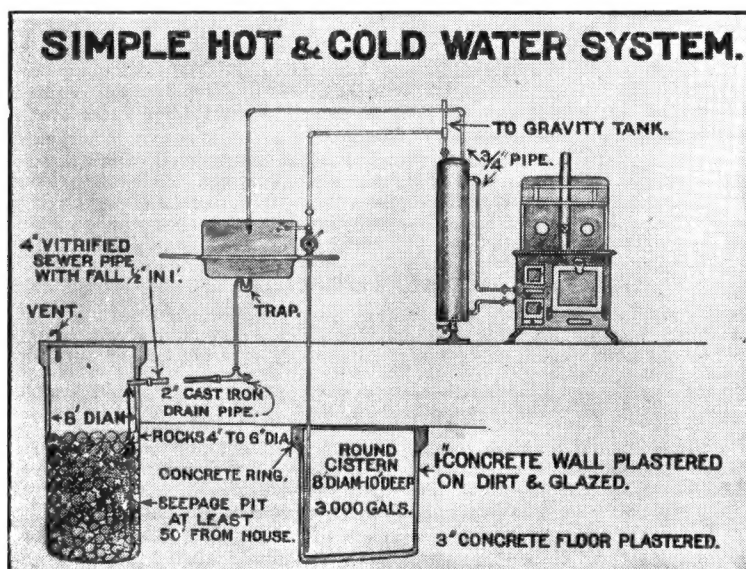


Figure 5.—Beginning of a Permanent Water and Disposal System

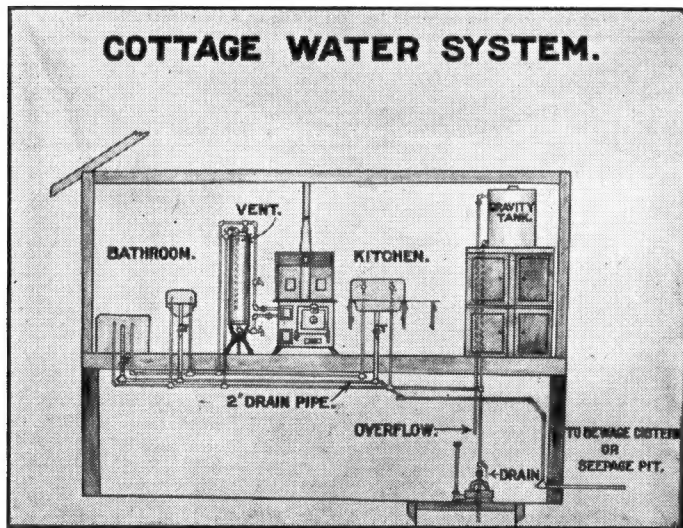


Figure 6.—Gravity Tank in the Kitchen to Prevent Freezing

sloped to the centre so that the cistern can easily be cleaned out. The floor should be 3" to 4" thick and plastered with the cement plaster as the walls. As soon as the floor is hard the entire inside of the cistern must be glazed with a coating of neat cement and water mixed to a thick creamy consistency. The cement wash can be applied with a whitewash brush. Two coats of glazing makes the cistern watertight.

The first filling of water in the cistern will become hard from the cement walls. The water can be pumped out after becoming hard. The next filling of water will not be hard. The walls may be painted with waterglass to prevent the water from hardening from the cement walls, if desired.

THE CIRCULAR CONCRETE SYSTEM

It may be desired to use concrete instead of cement plaster for the construction of the circular cistern. The concrete construction is more costly than the cement plastered cistern. Where forms are available in the community the cost of lumber is reduced. Care must be taken in the installation of forms to insure adequate strength and proper alignment. A 3' to 4' wall is adequate. A mixture of one part cement to five parts sharp gravel, properly mixed, will provide a good wall. The walls must be plastered with one coat of cement plaster consisting of 2 parts sharp gravel to one part cement and finally glazed with neat cement glazing consisting of water and cement applied with a brush. The top of the cistern may be covered with a concrete slab or be arched to a 24" manhole cover.

RECTANGULAR CISTERN

Where the ground water is too close to the surface or the soil is of a nature not suitable for plastering the rectangular cistern must be built. The rectangular cistern placed in one corner of the cellar must be strongly built, using 6" to 12" walls reinforced with rods throughout. The cistern walls must be separate from the walls of the cellar or house foundation. Leaks are often the result of using the foundation of the house as one wall of the cistern without proper reinforcing. The following tables indicate the spacing of rods in the floor and walls of concrete cisterns of various dimensions.

Size and Spacing of Rods in the Floor of a Concrete Cistern

Depth of Tank	Spacing of 3/8" Round Rods	Spacing of 1/2" Round Rods	
3'	10"	—	
4'	8"	16"	
5'	7 1/2"	15"	
6'	7 1/2"	14"	
7'	6 3/4"	13"	
8'	6"	12"	
9'	5"	10"	
10'	4"	8"	

Size and Spacing of Rods for the Walls of a Concrete Cistern

Depth of Tank Feet	Thick-ness of Wall Inches	Spacing of 3/8" Round Rods		Spacing of 1/2" Round Rods		Spacing of 3/4" Round Rods	
		Vertical Inches	Horizontal Inches	Vertical Inches	Horizontal Inches	Vertical Inches	Horizontal Inches
3	5	5	10	10	20	—	—
4	5	4	8	8	16	16	32
5	5 1/2	3	6	6	12	12	24
6	6	2 1/2	5	5	10	10	20
7	8	—	—	3	6	7	14
8	9 1/2	—	—	2 1/2	5	5	10
9	10	—	—	—	—	5	10
10	12	—	—	—	—	4	8

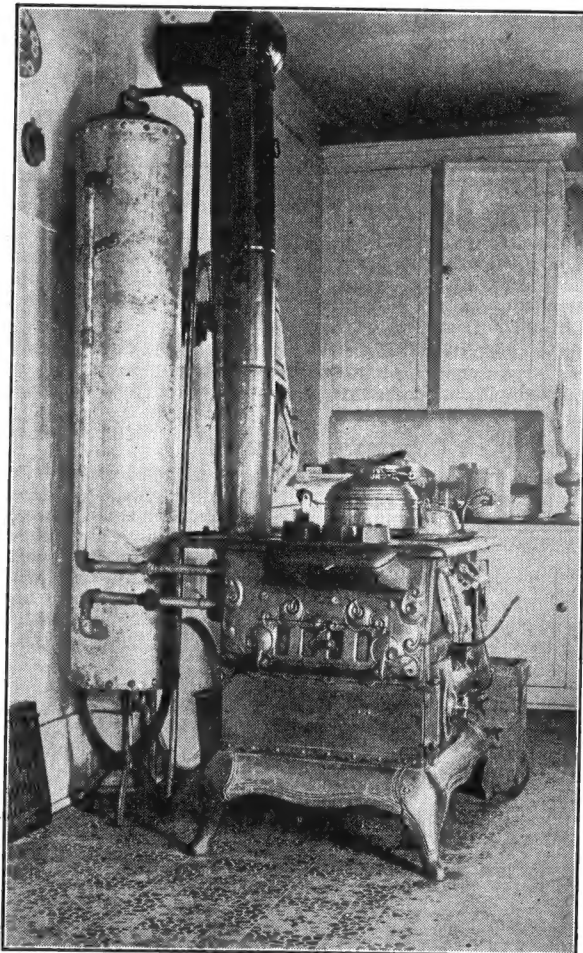


Figure 7.—Range Boiler Connected to the Water Front of the Kitchen Range

The concrete should consist of one part cement to four parts clean sharp gravel and as little water as is required for the proper consistency. The inside walls of the cistern should taper out as the walls rise. A 6" concrete floor is required. The entire inside of the cistern should then be plastered with cement plaster and be glazed as in the case of the circular cistern.

The cistern built and filled with water, the next problem is how to get the water to run to the kitchen as hot and cold water.

WATER SYSTEMS

Two general systems are available for conducting water to the various service points about the house, the Pneumatic pressure system and the Gravity system.

The Pneumatic Pressure System

The hand operated Pneumatic system is satisfactory for a two or three-storey house where the 20" x 60", 68-gallon capacity tank is used. A smaller tank requires frequent hand pumping to maintain working pressures. Electric power from either the transmission line or the farm lighting plant is required

for the automatic pressure systems (Figure 4). The Pneumatic systems are assembled as a unit consisting of a motor driven pump, an expansion tank and automatic pressure control valves. The size of the motor, pump, and tank, depends upon the desired capacity

RURAL WATER AND DISPOSAL SYSTEM.

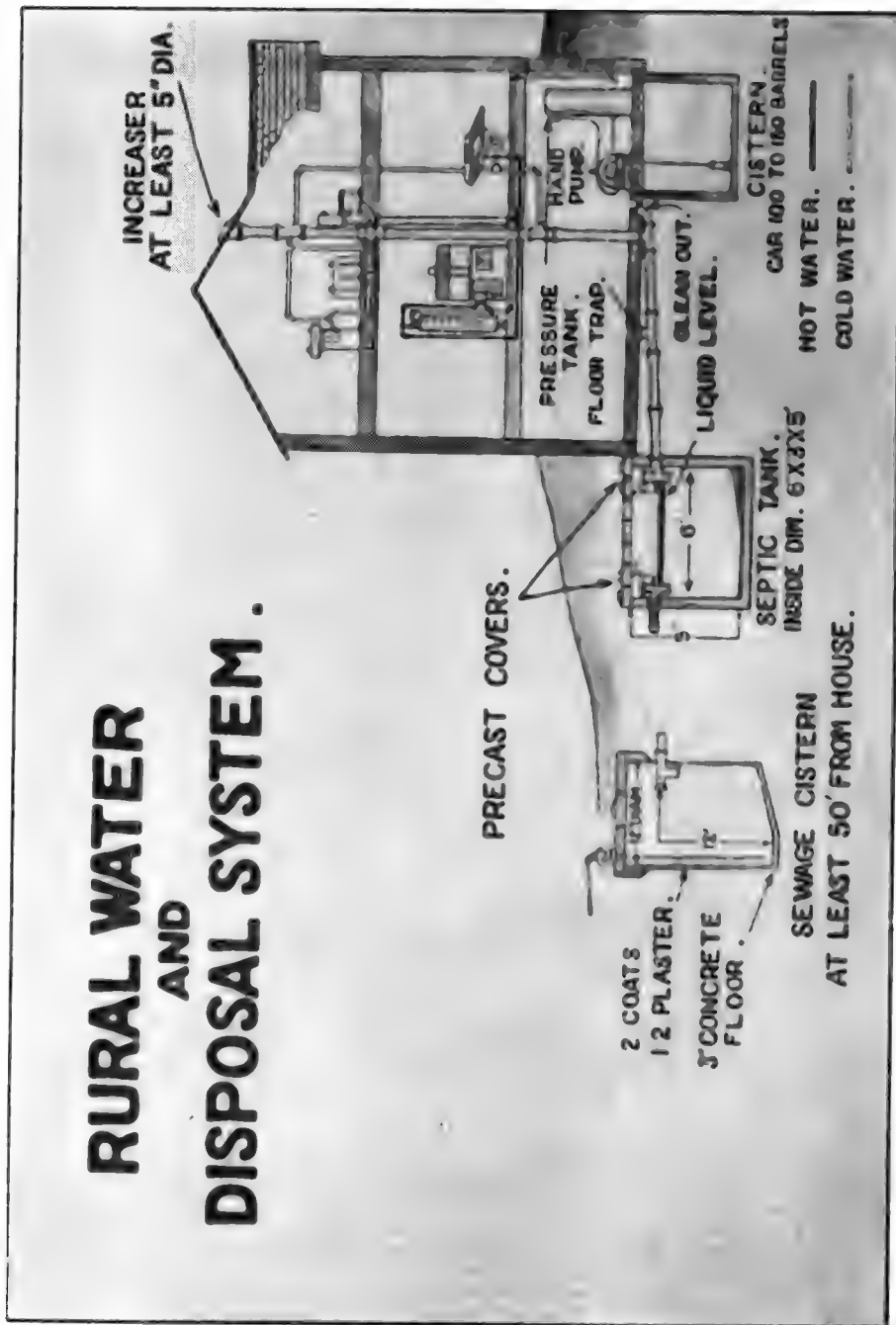


Figure 4.—Complete Water and Disposal System

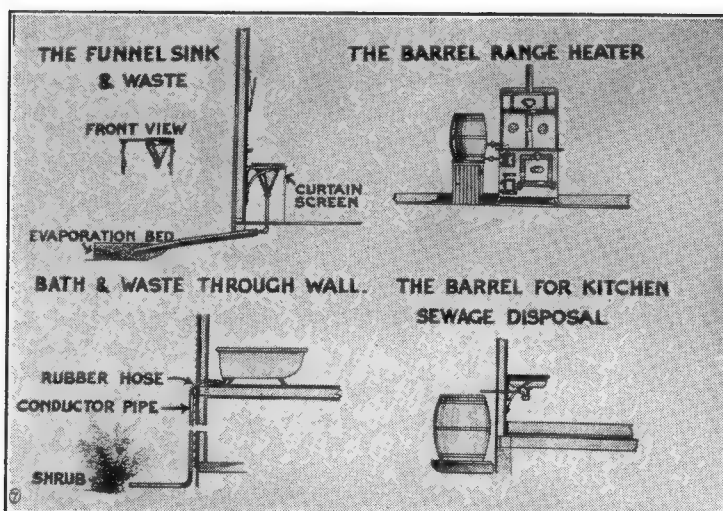


Figure 9.—Temporary Disposal

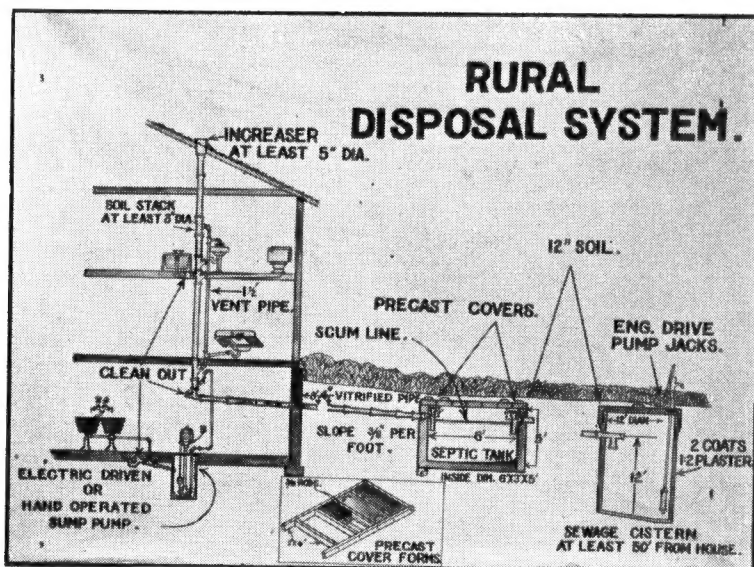
of the system. The motor is fitted with an automatic switch which is operated by variation in discharge pressure from the tank. The water pressure can be maintained between quite satisfactory working pressures. The unit assembly is usually placed in the basement where all pipes will be protected from frost. The distribution to the range boiler, sink, bath, etc., will go from the pressure tank.

Gravity System

The gravity system is not automatic in operation, but is much less expensive to install and is operated by hand quite satisfactorily. This system does not need to be put in all at once if not convenient. A small force pump can be placed at the sink to pump cold water to the sink and to the range boiler. A valve is necessary just above the pump so that the water to the range boiler may be shut off when pumping water directly into the sink. A range boiler of any desired capacity should be placed at the stove so that it may be connected easily to the water front of the stove. (Figure 7.) The hot water pipe from the water front in the stove may either be connected in the top of the two side plugs or may be connected at the top as in Figure 6. Hot water may be had more quickly after a fire has been started when the hot water pipe is connected at the top. The water in the tank can then take care of the expansion when being heated. A pipe can also be run from the cold water line to the sink, thus providing both hot and cold water taps at the sink.

The gravity tank should be placed where it will not freeze. Both the gravity tank and the range boiler may be placed upstairs in the bathroom. The gravity tank can be placed at the top of the room with a linen closet and shelves below the tank. The tank should be fitted with an overflow pipe to prevent the tank from running over. Where the entire house freezes but the kitchen, the gravity tank may be placed on the top of a cupboard in the kitchen (Figure 6). The water level in the tank must be higher than the range boiler for good operation.

A double acting pump of larger capacity may be substituted for the smaller pressure pump at the sink (Figure 6). The pump would then be placed in the cellar on top or beside the cistern convenient for pumping by hand. The overflow pipe should be extended down into the cellar so that a drop or two of water would be noticed by the one pumping, thus preventing overflowing of the tank. The bathtub and fixtures can be added to the system whenever desired. The cistern and entire water system can be made and installed at home without a great deal of cost. Two pipe wrenches, a hacksaw for cutting the pipe are about all of the tools required. It is necessary to take the shorter lengths into town to someone with a die for threading after the pipe has been cut to the right length. The labour saved by running water and the convenience of the hot and cold water always on tap more than offset the labour and cost of installation.



WASTE WATER DISPOSAL

The Slop Pail

The slop pail in the corner or under the sink is too often the only way provided for disposing of waste water from the kitchen. The pail fills quickly and is often emptied on the ground in the yard. The water sours and rapidly becomes a menace providing a place for flies and odors. Some other place for waste disposal is most urgently needed.

The Kitchen Sink

A kitchen sink 6" deep of almost any size or cost can be had. The sink should be placed on a partition, in place of on an outside wall, in order to prevent freezing of the pipes.

Height of the Sink

The sink should be mounted 36" high for the average person when standing at the sink. The sink can be temporarily connected through a trap to a hole in the ground which is filled with rock so that the waste water will have an opportunity to soak away into the ground (Figure 5). The pipe from the house to the hole may be temporary, consisting of 1 x 4 planed lumber used to form a square pipe and should have at least 2½ foot fall to 100 feet so that the water would flow rapidly out of the pipe into the hole, thus preventing freezing in the winter.

The permanent drain should be of 4" vitrified sewer pipe, laid with the joints cemented and the same fall as the wooden drain. The hole in the ground may serve for a good many years or may fill up in a year or so, thus making some more permanent system necessary.

TEMPORARY DISPOSAL

Water from the sink or the bath may be disposed of in a number of temporary ways. See Figure 9. A barrel placed outside the house on a stoneboat will collect the water from the sink. It may be drawn away periodically and dumped to water trees or bushes.

Water may be conducted from the bath through 3" galvanized water spouts down to trees and shrubs or to a hole in the ground. Bath water is quite all right to use for watering trees or shrubbery.

The hole in the ground filled with rock provides a very satisfactory disposal for sink, wash, or bath water. Where the soil is porous, such temporary disposal is almost in the nature of a permanent one in that it works winter and summer for years without requiring attention. When digging the hole, it should be dug with a team and slip scraper.

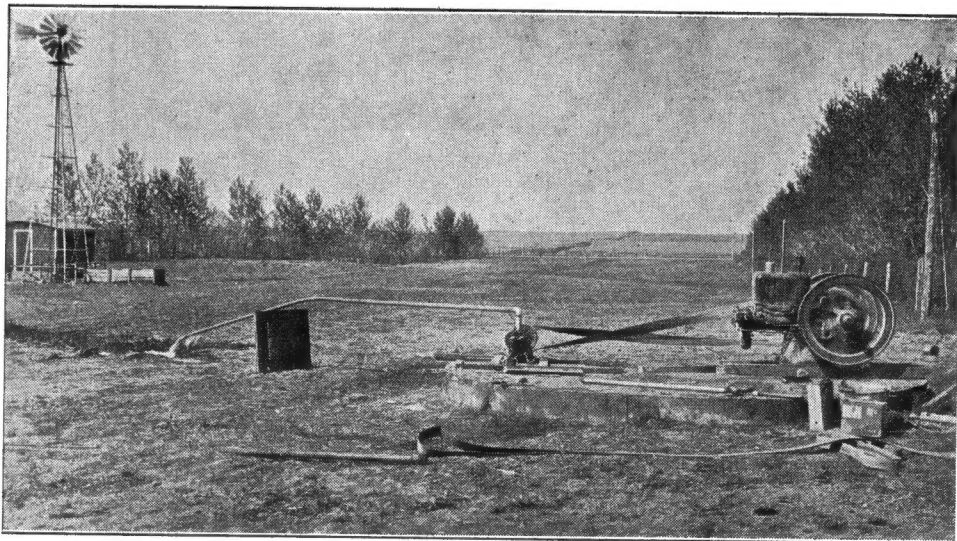


Figure 11.—Pumping Equipment for Sewage Disposal

It should be rather long and narrow, deep enough to be below the frost level in winter. It should slope away from the intake so that the water will flow away during seepage. The pipe line to the hole may be of tile or wood. It should have plenty of fall so that the water will keep the pipe clean and will flow with considerable velocity through the pipe as it flows from the sink, bath or wash tub to the hole. Where the square wooden pipe is used, it should be laid on one corner, so that the water will wash out the pipe cleanly even when the volume of water to the waste is small.

PERMANENT DISPOSAL

Waste Water Disposal

Where a flush toilet is not used, waste water from the kitchen, laundry, and bath can be disposed of into a row of trees or seepage pit. One convenient method of accomplishing this is to provide either a hand operated or electrically operated sump pump with a tank of 100 gallon capacity. All facilities drain into the sump or tank (see figure 10 of the sump pump) which is pumped out either manually or automatically when filled. The 100 gallon capacity means that 65 to 70 gallons of waste water will be pumped out once or twice each week depending on the size of the family and the water being used. This system can be made to operate winter or summer. A chemical toilet could very well be used in conjunction with this system. The refuse from a chemical toilet must be removed periodically and buried at some distance from the buildings. The tank must be recharged with a solution of the caustic chemical before it is again ready for use.

Sewage Disposal

Sewage disposal is the disposal of all waste water from the farm home including that from the flush toilet. Special treatment of the sewage is required to insure sanitation. Sewage disposal requires a considerable expenditure to complete the process. The system may, however, be put in part at a time as time and money will permit.

The Sewage Cistern

The sewage cistern is a waste water cistern placed some 50 to 100 feet out from the house to collect the waste water. The cistern should be at least 8 feet in diameter and 8 to 10 feet deeper than the inlet so that it will need to be pumped out only two or three times each year. It should be placed in the direction of a natural slope and away from the well. The cistern should be made of cement plaster and concrete similar to the soft water cistern. Whenever the water rises to near the inlet pipe the water should be pumped out into a hedge or line of trees so that the water will be quickly absorbed

from the surface. The sewage cistern may be put in to take care of sink wash and bath water before the flush toilet is added. The expense of adding the septic tank can be deferred until it is desired to add the flush toilet. When the flush toilet is added, the septic tank must be installed either just outside the house or at the sewage cistern. (Figures 8 and 10.)

The septic tank consists of a small concrete tank 3' x 5' x 6' placed as illustrated. The septic tank must be fitted with Tee inlets and outlets to prevent the scum on the surface of the liquid from being disturbed when liquid is entering the tank from the toilet and flowing from the tank into the sewage cistern. Where such tees are not available, baffles must be placed in front of both the inlet and outlet pipes. The septic tank must be kept full of liquid at all times.

The process of sewage disintegration is the work of two classes of bacteria; the anaerobic, those found in the scum on the top of the liquid in the septic tank working in the absence of air, and the aerobic or those bacteria that work by reason of air out in the soil when the sewage cistern is pumped out or in the aerated soil of the seepage bed.

The sewage cistern is the only satisfactory method of disposal in clay soils where the soil is impervious to water seepage. The absorption bed is not practical for clay soils or even loam soils where no slope is available to drain the bed. The drain tile of the seepage bed gradually fills up until the system has to be dug up, cleaned out and relaid. (Figure 12). The only way that an absorption bed is satisfactory is when the bed is drained so that the liquid can get away from the drains.

There have been many satisfactory installations using the absorption field where the soil and drainage are satisfactory for field installation.

The construction of an absorption field is described fully in the Provincial Sanitation Bulletin No. 1, obtainable from the Department of Public Health, Parliament Buildings, Regina, Saskatchewan.

The sewage cistern can be put in to replace the seepage bed which has become filled up with sediment.



Figure 12.—Tile from Seepage Bed

The installation of the waste water system is not beyond the average farmer with a few tools and a general understanding of how the pipes are connected. All of the traps and smaller drain fittings may be threaded together. Only the 4" cast iron soil pipe has leaded joints. Lead wool is available so that the joints can be made by caulking oakum into the bell joints and then filling with the lead wool. The system must be vented up through the roof and provided with suitable cleanouts so that the drains can be pushed out if necessary. The work can be done when the farm work is light so that the cost for labour can be low. The waste system should be carefully planned so that when all installations are completed, modern disposal will be provided for the farm home. The local plumber will undoubtedly be able to render valuable assistance in planning the piping and also in making many of the installations.

The comforts and conveniences of the modern home are not prohibitive and may be had in every farm home if desired. If the farm kitchen is to be convenient and efficient so that the work can be done well, there must be suitable running water and waste water disposal.

Supplemental information may be had from the bulletin "Rural Sewage Disposal," available from the Ontario Agricultural College, Guelph, Ontario, price 25 cents.

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